

# Epidemiology of Intestinal Parasite Infections among Kindergarten Children in Mekelle Town, Northern Ethiopia

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## Abstract

**Back ground:** Intestinal parasitic infections are among the major public health problems in the Sub-Saharan Africa. However, surveys for intestinal parasites conducted in different areas of Ethiopia focused on school age children. Consequently, there is scarcity of data on the burden of intestinal parasites among children in Kindergartens.

**Material and Method:** This cross-sectional study was conducted in three Kindergartens in Mekelle City, North Ethiopia from October to November 2013. A total of 400 (240 male and 160 female) pre-school children were eligible to provide stool samples. Wet mount preparations and Kato Katz technique were applied to process stool samples.

**Results:** The overall prevalence of intestinal parasitic infection was 29.3% in the study. Six protozoan and helminthic parasites were identified and *Hymenolopis nana* was the predominant species (8.75%) followed by *Giardia lamblia* (5.75), *Entamoeba histolytica* (5%), *Enterobius vermicularis* (5%) and *Ascaris lumbricoides* (4%). Hookworms and *Schistosomiasis mansoni* were the least prevalent species.

**Conclusions:** Intestinal parasitosis was high in the study area which indicates a need for provision of anti protozoan and anti helminthics, sanitation, provision of safe water supply and latrines accompanied by appropriate health education.

**Key words:** Mekelle, Ethiopia, Kindergarten, Parasite

## 1. Introduction

Intestinal parasitic infections are endemic worldwide and have been described as constituting the greatest single worldwide cause of illness and disease (Diana *et al.*, 2000). The World Health Organization estimated that 2 billion individuals are infected with intestinal parasites worldwide with clinical morbidity in 450 million people (WHO 2002). Many of these are children in developing countries ( Shewakena 1995; Tadesse and Tsehaye 2008; Girum 2005; Thiong'o *et al.*, 2001; Merid 2001; Mengistu and Berhanu 2004; Fekadu *et al.*, 2008). Studies indicated that intestinal parasitic infections result in malnutrition, morbidity, mortality and socioeconomic problems owing treatment cost and hospitalization (Quihui *et al.*, 2006; Shewakena 1995).

In children, intestinal parasites are one of the world's most important causes of physical and intellectual growth retardation leading to attention deficits, learning disabilities, school absenteeism and higher dropout rates ( Magambo *et al.*, 1998; Mengistu and Berhanu 2004; Asfaw and Goitom 2000). Yet, despite their educational, economic, and public-health importance, they remain largely neglected by the medical and international community (Jeffrey *et al.*, 2006; Brooker and Micheal 2000).

Preschool children, defined as aged less than five years, make up between 10%–20% of the two billion people worldwide who are infected with different intestinal parasites (De Silva *et al.*, 2003). Although, children of these age groups are less likely to harbor heavy infections, their worm burdens are housed in smaller bodies, and therefore they are at a higher risk of anemia, wasting and malnutrition (Awasthi and Pande 2001; Gendrel *et al.*, 2003).

Intestinal parasitism has been widespread in Ethiopia. For instance, parasitic infections are the second most predominant causes of outpatient morbidity in the country. The effect of altitude, urbanization, irrigation, and resettlement on the distribution of intestinal parasitism was depicted in previous studies ( Jemaneh 2000; Erko *et al.*, 2004). Poverty, illiteracy, poor hygiene, lack of access to potable water and hot and humid tropical climate are the factors associated with intestinal parasitic infections in Ethiopia (Merid 2001; Asfaw and Goitom 2000; Legesse and Erko 2004). Surveys for intestinal parasitoses conducted in different areas of the country focused on the school children. Hence there is scarcity of data on the burden of intestinal parasites in pre-school

(Kindergarten) children in the study area and elsewhere in Ethiopia. In light of this, the present study aimed to determine the prevalence of intestinal parasites among the kindergarten children in Mekelle city, North Ethiopia.

## 2. Materials and Methods

This cross-sectional study was conducted among pre-school children in three private Kindergartens, (namely; Freedom, Universal, and Wehazit), North Ethiopia from October to November 2013. These kindergartens are found in Mekelle city in Tigray Region. Mekelle city has a latitude and longitude of 13029' North 39028' East with an elevation of 2084 meters above sea level. The area has an average temperature of 24.3 °C and precipitation of 722 mm annually.

### 2.1 Stool collection and examination

Assistants from the Kindergartens were trained and instructed to collect sufficient amount of stool from the pre-school children. Then these assistants were provided with labeled clean plastic sheet, toilet tissue paper and pieces of applicator sticks. Stool specimens were immediately processed by direct smear (wet mount examination) to detect trophozoites of intestinal protozoa using 0.85% NaCl by 10x and 40x microscope objective. In parallel, Samples were processed by Kato Katz technique (template conveying 41.7 mg of stool), to quantify the intensity of soil-transmitted helminthes (*Ascaris lumbricoides*, hook worms and *Trichuris trichuria*) and *Schistosomiasis mansoni*. Intensity of infection was estimated from the number of eggs per gram of faeces (epg). Based on egg counts, cut-off values for classification of intensity of infection were used. Intensity of *S. mansoni* was classified into: light infection (1-99epg), moderate (100-399 epg) and heavy (greater than 400 epg). Similarly, the classification for *A. lumbricoides* is: light infection (1-4999epg), moderate (5000-49999epg) and heavy (greater than 50,000epg). Intensity of *T. trichiura* is: light infection (1-999epg), moderate (1000-9999 epg) and heavy (greater than 10,000epg). Classification of hookworm is: light infection (1-1999epg), moderate (2000-3999 epg) and heavy (greater than 4,000epg) (WHO 2002).

### 2.2 Quality control

Prior to commencement of the work, the cellophanes (Kato Katz technique) were checked if they were appropriately soaked in glycerin-malachite green solution and the instruments were also checked by a senior laboratory technician. Specimens were also looked over for their labels and adequacy.

### 2.3 Data analysis

Data were coded, entered into computer and cleaned before and during data processing using EPI INFO version 6 and exported to SPSS version 16.0 software package for statistical analysis. Different variables were described and characterized by frequency distribution. Prevalence and intensity of *S. mansoni* and Soil-transmitted infection were reported in percent and mean egg count, respectively. The association was statistically tested using univariate and multivariate regression analysis. The magnitude of association was measured by odds ratio at 95% CI: P-value below 0.05 was considered as statistically significant.

### 2.4 Ethical clearance

Ethical clearance to conduct the research was obtained from Institutional Review Board (IRB) of College of Health Sciences, Mekelle University. Prior to data collection, the objectives of the study were clearly discussed with the kindergartens' community. Written informed consent was obtained from the parents/caretakers of the pre-school children.

## 3. Results

### 3.1 Description of the study participants

A total of 400 pre-school children took part in the study and 58.6% were male and 41.4% female. The mean age of the study participants was 4.7 years. Eighty four (21%) males and 33(8.3%) females were positive for intestinal parasites. There was statistically significant difference in intestinal parasitosis between males and females ( $p=0.02$ ). This study also indicated that children of 5-5 11/12 years age harbored significantly high parasitic infections ( $p=0.015$ ) (table 1).

Table 1. Intestinal parasitosis by sex and age of children in the Kindergartens of Mekelle City, North Ethiopia.

Categories	Total (%)	Infected (%)
Sex		
Male	240 (60%)	84 (21)
Female	160 (40%)	33 (8.25)
P value <sup>†</sup>	NA	0.02*
Age		
3-3 11/12	126 (31.5%)	20 (5)
4-4 11/12	100 (25%)	29 (7.25)
5-5 11/12	174(43.5%)	68 (17)
P value <sup>†</sup>	NA	0.015*

\* Significant difference; † Chi square; NA, not applicable.

### 3.2 Prevalence of intestinal parasite infections

The overall prevalence of intestinal parasitosis was 29.3%. Six different species of intestinal parasites (namely; *H. nana*, *G. lambia*, *E. histolotica*, *E. vermicularis*, *A. lumbricoides*, Hookworms and *S. mansoni*) were identified. All examined pre-school children had a single parasitic infection.

Table 2. Prevalence of different intestinal parasite species among children in the Kindergartens of Mekelle City, North Ethiopia.

Types of parasites	Positive (n=117)	Positive %
<i>H. nana</i>	35	8.75
<i>G. lambia</i>	23	5.75
<i>E. histolotica</i>	20	5
<i>E.vermicularis</i>	20	5
<i>A.lumbricoides</i>	16	4
Hook worms	3	0.75
<i>S. mansoni</i>	1	0.25
P value <sup>†</sup>	0.006*	NA

\* Significant difference; † Chi square; NA, not applicable.

Moreover, the intensity of each parasite among the study participants was also determined. Accordingly, the intensities of all helminthic infections were found to be light.

Table 3. Risk factors for intestinal parasitic infections among children in the Kindergartens of Mekelle City, North Ethiopia.

Finger nail status	Positive (n=117)	Positive %
Trimmed	53	13.25
Untrimmed	64	16
P value <sup>†</sup>	0.0025*	NA

\* Significant difference; † Chi square; NA, not applicable.

## 4. Discussion

Epidemiological study on the prevalence of infection of intestinal parasites in different regions/localities is a primary objective to identify high-risk communities and formulate appropriate intervention (Tesfa-Michael 2003). In line with this view, the present study attempted to assess the prevalence of different intestinal parasitic infections in Kindergarten children in Mekelle City, North Ethiopia. The results of the study showed the occurrence of several intestinal parasites of public health importance among the children.

Many studies have already indicated prevalence intestinal parasites among Ethiopian children in various parts of the country. However, there was scarce data on the prevalence of intestinal parasitosis among children in Kindergartens as most surveys were conducted rather among school age children. The overall prevalence of intestinal parasitic infection was 29.3% among the kindergarten children in this study. This was lower than findings from a study conducted in Aynalem village, only 5 kilometers from the current study site (Asfaw and

Goitom 2000), Central Ethiopia (Tesfa-Michael 2003), North west Ethiopia (Shewakena 1995). On the other hand similar findings were reported from Tigray region and eastern Ethiopia which revealed overall prevalence of 28.6% and 27.2%, respectively (Tadesse and Tsehaye 2008; Girum 2005). In contrast, the finding of the present study was higher than reports from Kenya (Thiong'o *et al.*, 2001) and Sudan (Magambo *et al.*, 1998) that showed prevalence of 12.9% and 12.3%, respectively. The differences in findings among the studies can be explained by variations in geography, socio-economic and hygienic conditions of the population under consideration.

Prevalence of overall parasite infection among the Kindergarten children was linearly age dependent with the highest infection rate being observed among those between the ages of 5 to 6 years. This is possibly as a result of the increased exposure of the child to infective stages with increased mobility and weaning practices. On the other hand the low prevalence of intestinal parasites among younger age group (3-3 11/12) is indicative of limited motility and hence limited exposure to pathogens.

In the present study, *H. nana* was found to be the dominant intestinal parasite (8.75%). This was consistent with a previous study in a nearby village. Contradictory findings were reported from South Ethiopia. The prevalence of *Acaris lumbricoides*, *S. mansoni* and hookworm infection was lower in this study and this was in agreement with findings from study conducted in the eastern part of the country. In contrary to the present finding, higher rates of hookworm were also reported near lake Awassa (62.5%), Langanu (64.7%) and South west Ethiopia (40.8%) (Merid 2001; Mengistu and Berhanu 2004; Fekadu *et al.*, 2008).

Regarding gender, this study has shown that females were at lower risk of parasitic infection and this is more likely to be influenced by limited outdoor motility and better access for sanitation. This study also documented the existence of association between untrimmed finger nails and higher rate of intestinal infection in the Kindergarten children.

## 5. Conclusion

In conclusion, the present study has revealed high prevalence of intestinal parasite infection among the kindergarten children in Mekelle City. Male sex, age group & 5 to 5 11/12 years and untrimmed finger nails were significantly associated with intestinal parasitosis. Hence, high prevalence of intestinal parasitosis in the study area showed the need for provision of anti protozoan and anti helminthics, sanitation, provision of safe water supply and latrines to reduce human-water contact accompanied by appropriate health education.

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